

KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
ELECTRICAL ENGINEERING DEPARTMENT

EE-463

Key Solution

Quiz # 1 Serial #

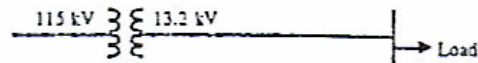
Name:

I.D.#

A three-phase transformer rated 5 MVA, 115/13.2 kV has per-phase series impedance of $(0.007 + j0.075)$ per unit. The transformer is connected to a short distribution line which can be represented by a series impedance per phase of $(0.02 + j0.10)$ per unit on a base of 10 MVA, 13.2 kV. The line supplies a balanced three-phase load rated 4 MVA, 13.2 kV, with lagging power factor 0.85.

Draw an equivalent circuit of the system indicating all impedances in per unit. Choose 10 MVA, 13.2 kV as the base at the load.

Base voltages are shown on the single-line diagram.



$$\text{Transformer } Z = \frac{10}{5} (0.007 + j0.075) = 0.014 + j0.150 \text{ per unit}$$

$$V_s = 1.0 \text{ per unit}$$

$$\text{Line } Z = 0.02 + j0.10 \text{ per unit}$$

$$\text{Load } |Z| = \frac{(13.2)^2 \times 1000}{3400/0.85} = 43.56 \Omega$$

$$\text{Base } Z \text{ at load} = \frac{(13.2)^2}{10} = 17.42 \Omega$$

$$\begin{aligned} \text{Load } Z &= \frac{43.56}{17.42} \angle \cos^{-1} 0.85 = 2.50 \angle 31.8^\circ \\ &= 2.125 + j1.317 \text{ per unit} \end{aligned}$$

